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DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

01245/TL

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/830378

INTERNATIONAL APPLICATION NO.

PCT/FR99/02639

INTERNATIONAL FILING DATE

28 October 1999

PRIORITY DATE CLAIMED

29 October 1998

TITLE OF INVENTION DEVICE AND METHOD FOR MAKING AN INTEGRATED CIRCUIT SECURE

APPLICANT(S) FOR DO/EO/US Eric GERBAULT

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

Form PCT/IB/308

CHANGE OF CORRESPONDENCE ADDRESS
APPLICATION
ASSIGNMENT INFORMATION FOR
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EL 759 977 166 US

Date of Deposit

April 25, 2001

I hereby certify that this paper and any papers identified herein
is being deposited with the United States Postal Service "Express
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Commissioner for Patents, Washington, D.C. 20231

Yolanda Usher
Yolanda Usher

U.S. APPLICATION NO. (USPTO FORM 73) (CFR 1.5)		INTERNATIONAL APPLICATION NO.		ATTORNEY'S DOCKET NUMBER	
09/830378		PCT/FR99/02639		01245/TL	
17. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)) : Search Report has been prepared by the EPO or IPO\$860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482)\$690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) . \$750.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,000.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$ 860.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	8 - 20 =	0	x 18.00	\$ 0	
Independent claims	2 - 3 =	0	x 80.00	\$ 0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			x 270.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$ 860.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$	
SUBTOTAL =				\$ 860.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$ 860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$	
TOTAL FEES ENCLOSED =				\$ 860.00	
				Amount to be refunded	\$
				charged	\$

- a. ☒ A check in the amount of \$ 860.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 06-1378. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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Date: April 25, 2001

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Thomas Langer

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27,264

REGISTRATION NUMBER

09/830378

JC03 Rec'd PCT/PTO 25 APR 2001

Attorney Docket No. 01245/TL

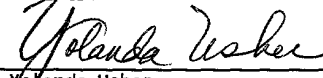
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**IN THE UNITED STATES PATENT
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Applicant(s): Eric GERBAULT

Serial No. : Not Yet Assigned (U.S. Natl.
Phase of PCT/FR99/02639 filed
10/28/99)


Yolanda Usher

Filed : CONCOMITANTLY HEREWITH

For : DEVICE AND METHOD FOR MAKING
AN INTEGRATED CIRCUIT SECURE

Art Unit :
Examiner :

PRELIMINARY AMENDMENT

BOX PCT

Asst. Commissioner for Patents
Washington, D.C. 20231

S I R :

Please amend the above-identified application as follows:

IN THE SPECIFICATION

Please insert the following as the first sentence of the above-identified application:

--This application is a U.S. National Phase Application under 35 USC 371 of International Application PCT/FR99/02639 (not published in English) filed 28 October 1999.--

200503080000

Page 1, before the paragraph starting on line 2, insert the following heading:

--FIELD OF THE INVENTION--

Between lines 7 and 8, insert the heading

--BACKGROUND OF THE INVENTION--.

Page 2, between lines 10 and 11, insert the heading

--SUMMARY OF THE INVENTION--.

Page 3, between lines 10 and 11, insert the heading

--BRIEF DESCRIPTION OF THE DRAWINGS--.

Page 3, between lines 27 and 28, insert the heading

--DETAILED DESCRIPTION OF THE DRAWINGS--.

IN THE CLAIMS

Change the heading to --I CLAIM--.

Please amend claims 1-8 as follows (see attachment for details of changes):

1. (Amended) An integrated circuit device containing a memory area that comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks, N being an integer greater than 1, characterized in that

5 said memory area has M replicas, M being an integer greater than
1, of x program code blocks, x being an integer comprised between
1 and N, wherein said replicas reside at different addresses
within said memory area, and in that said device comprises
selection means for randomly selecting one replica of at least
10 one of the x blocks as a block replica to be used when executing
said program.

2. (Amended) A device according to claim 1, characterized
in that the sums of bit values of at least two addresses among
the set of addresses of one replicated block and its M replicas
are different.

3. (Amended) A device according to claim 1, characterized
in that, among the set of addresses of one replicated block and
its M replicas, one address resides within the program memory and
another address resides within the data memory.

4. (Amended) A device according to claim 1, characterized
in that it comprises controller means for randomly scheduling
block execution.

5. (Amended) A method for making secure an integrated
circuit device containing a memory area, which comprises, on the
one hand, a data memory and a program memory, and on the other
hand, a program having N code blocks, N being an integer greater

5 than 1, characterized in that said method comprises the steps of:

- generating, within said memory area, M replicas, M being an integer greater than 1, of x program code blocks, x being an integer comprised between 1 and N, wherein said replicas reside at different addresses within said memory area, and

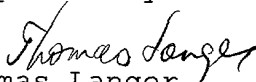
10 - randomly selecting one replica of at least one of the x blocks as a block replica to be used when executing said program.

6. (Amended) A method according to claim 5, characterized in that said method comprises the additional step of selecting the sums of bit values of at least two addresses among the set of addresses of one replicated block and its M replicas in such a way that they are different.

7. (Amended) A method according to claim 5, characterized in that, among the set of addresses of a replicated block and its M replicas, an address is selected within the program memory and another address is selected within the data memory.

8. A method according to claim 5, characterized in that said method comprises the additional step of randomly scheduling block execution.

Respectfully submitted,


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DEVICE AND METHOD FOR MAKING AN INTEGRATED CIRCUIT SECURE

5 This application is a U.S. National Phase Application
under 35 USC 371 of International Application
PCT/FR99/02639 (not published in English) filed 28 October
1999.

FIELD OF THE INVENTION

10 The present invention relates to an integrated circuit
device containing a memory area, which comprises, on the
one hand, a data memory and a program memory, and on the
other hand, a program having n code blocks B_i ($i = 1, \dots, N$). It further relates to a method for making such a device
secure.

BACKGROUND OF THE INVENTION

15 Integrated circuit devices of this kind are most often
used in applications where confidential information storing
and processing security is essential. These can for example
be electronic component-carrying cards for applications
relating to the fields of health, mobile telephony, or also
banking applications.

20 Such cards comprise an integrated circuit which
conventionally includes a controller for (for example a
central processing unit or CPU) managing and distributing,
through bus lines, data or address information that is
stored within the memory area of said cards. This
25 integrated circuit having bus lines consumes electrical
power, in particular when these bus lines are used to carry
logical 1 information.

30 Also, the intensity of the electrical current used by
an electronic component-carrying card varies with time, in
particular because of the different values of data or
addresses transiting over said bus lines in the card. The
current change as a function of time is an electrical
signature of the card's activity and therefore, analyzing
said signature is indicative of said activity. Thereby, by
35 means of an analysis of the electrical signature, forgers,
for example, can easily follow a succession of operations

contained in the different code blocks of the program of said card and therefore, can access the confidential information contained in this card.

5 In order to make the analysis of the electrical signature more complex to forgers, the state of the art suggests providing auxiliary devices for generating spurious signals that are added to the electrical signature of said electronic component-carrying card's activity. Although they make the electrical signature analysis more
10 delicate, such auxiliary devices are slow because they monopolize some of the card's resources, which resources are already used for executing other operations specific to the card and consume more current because they include electronic components that require electrical power for their operation.

SUMMARY OF THE INVENTION

Thus, one technical problem to be solved by the present invention is that of providing an integrated circuit device containing a memory area that comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks B_i ($i=1, \dots, N$), as well as a method for making such a device secure, for obtaining an electrical signature in such a way that said signature is difficult to analyze and which further requires little
25 power and time consumption, for example due to auxiliary devices appropriating the device's own resources.

According to a first object of the present invention, a solution to the technical problem posed is characterized in that said memory area of said integrated circuit device comprises M replicas C_j ($j = 1, \dots, M$) having x program code blocks B_i ($x = 1, \dots, N$), said replicas residing at different addresses within said memory area, and in that said device comprises selection means for randomly selecting a replica C_j of at least one of the x blocks B_i ,
30 as a block replica to be used when executing said program.

35 According to a second object of the present invention, this solution is characterized in that the securing method comprises the steps of:

- creating, within said memory area, M replicas C_j ($j = 1, \dots, M$) of x program code blocks B_i ($x = 1, \dots, N$), wherein said replicas reside at different addresses within said memory area, and

5 - randomly selecting one replica C_j of at least one of the x blocks B_i , as a block replica to be used when executing said program.

10 Therefore, as explained in detail below, the device according to the invention prevents forgery by making the analysis of the electrical signatures very difficult to analyze by such forgery, taking advantage of the fact that said electrical signature varies, in particular, as a function of the values transiting over said device bus lines.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Other features and advantages of the invention will become apparent from the following description of preferred embodiments of the present invention, provided by way of non-limiting examples, in reference to the appended Figures, in which:

Fig. 1 illustrates an integrated circuit device, such as, for example, an electronic component-carrying card.

Fig. 2 illustrates a memory area in the card of Fig. 1.

Fig. 3 illustrates bus lines in the card of Fig. 1.

25 Fig. 4 illustrates the memory area of Fig. 2 restricted to code block B_i .

Fig. 5 illustrates addressing of a code block and its replicas within the card of Fig. 1.

30 Fig. 6 illustrates a distribution of a code block and its replicas within a memory area of Fig. 2.

Fig. 7 illustrates another distribution of a code block and its replicas within the memory area of Fig. 2.

DETAILED DESCRIPTION OF THE INVENTION

35 Fig. 1 shows an integrated circuit device 10, for example an electronic component-carrying card.

Card 10 includes a controller (for example a central processing unit or CPU), a memory area 12 including a data memory 14 and a program memory 15, and a terminal block 13

AMENDED CLAIMS SHOWING CHANGES MADE TO CLAIMS

(U.S. Natl. Phase of Appln
No. PCT/FR98/02639).

[CLAIMS] I CLAIM

1. (Amended) An integrated circuit device containing a memory area that comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks, N being an integer greater than 1 [Bi (i = 1, ..., N)], characterized in that said memory area has M replicas [Cj (j = 1, ..., M)], M being an integer greater than 1, of x program code blocks [Bi (x = 1, ..., N)], x being an integer comprised between 1 and N, wherein said replicas reside at different addresses within said memory area, and in that said device comprises selection means for randomly selecting one replica [Cj] of at least one of the x blocks [Bi], as a block replica to be used when executing said program.

2. A device according to claim 1, characterized in that the sums of bit values of at least two addresses among the set of addresses of one replicated block [Bi] and its M replicas [Cj] are different.

3. (Amended) A device according to [any preceding claim] claim 1, characterized in that, among the set of addresses of one replicated block [Bi] and its M replicas, one address resides within the program memory and another address resides within the data memory.

4. (Amended) A device according to [any preceding claim] claim 1, characterized in that it comprises controller means for randomly scheduling block execution.

5. (Amended) A method for making secure an integrated circuit device containing a memory area, which comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks, N being an integer greater than 1 [Bi (i = 1, ..., N)], characterized in that said method comprises the steps of:

- generating, within said memory area, M replicas [Cj (j = 1, ..., M)], M being an integer greater than 1, of x program code blocks [Bi (x = 1, ..., N)], x being an integer comprised between 1 and N, wherein said replicas reside at different addresses within said memory area, and

- randomly selecting one replica [Cj] of at least one of the x blocks [Bi], as a block replica to be used when executing said program.

6. (Amended) A method according to claim 5, characterized in that said method comprises the additional step of selecting the sums of bit values of at least two addresses among the set of addresses of one replicated block [Bi] and its M replicas [Cj] in such a way that they are different.

7. (Amended) A method according to [claims 5 or 6] claim 5, characterized in that, among the set of addresses of a replicated block [Bi] and its M replicas, an address is selected within the program memory and another address is selected within the data memory.

8. A method according to [claims 5, 6 or 7] claim 5, characterized in that said method comprises the additional step of randomly scheduling block execution.

H/PRT

09/830378

JC03 Rec'd PCT/PTO 25 APR 2001

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DEVICE AND METHOD FOR MAKING AN INTEGRATED CIRCUIT SECURE

5 The present invention relates to an integrated circuit device containing a memory area, which comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having n code blocks B_i ($i = 1, \dots, N$). It further relates to a method for making such a device secure.

Integrated circuit devices of this kind are most often used in applications where confidential information storing and processing security is essential. These can for example be electronic component-carrying cards for applications relating to the fields of health, mobile telephony, or also banking applications.

20 Such cards comprise an integrated circuit which conventionally includes a controller for (for example a central processing unit or CPU) managing and distributing, through bus lines, data or address information that is stored within the memory area of said cards. This integrated circuit having bus lines consumes electrical power, in particular when these bus lines are used to carry logical 1 information.

25 Also, the intensity of the electrical current used by an electronic component-carrying card varies with time, in particular because of the different values of data or addresses transiting over said bus lines in the card. The current change as a function of time is an electrical signature of the card's activity and therefore, analyzing said signature is indicative of said activity. Thereby, by means of an analysis of the electrical signature, forgers, 30 for example, can easily follow a succession of operations contained in the different code blocks of the program of said card and therefore, can access the confidential information contained in this card.

35 In order to make the analysis of the electrical signature more complex to forgers, the state of the art

5 suggests providing auxiliary devices for generating spurious signals that are added to the electrical signature of said electronic component-carrying card's activity. Although they make the electrical signature analysis more delicate, such auxiliary devices are slow because they monopolize some of the card's resources, which resources are already used for executing other operations specific to the card and consume more current because they include electronic components that require electrical power for their operation.

10 Thus, one technical problem to be solved by the present invention is that of providing an integrated circuit device containing a memory area that comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks B_i ($i=1, \dots, N$), as well as a method for making such a device secure, for obtaining an electrical signature in such a way that said signature is difficult to analyze and which further requires little power and time consumption, for example due to auxiliary devices appropriating the device's own resources.

20 According to a first object of the present invention, a solution to the technical problem posed is characterized in that said memory area of said integrated circuit device comprises M replicas C_j ($j = 1, \dots, M$) having x program code blocks B_i ($x = 1, \dots, N$), said replicas residing at different addresses within said memory area, and in that said device comprises selection means for randomly selecting a replica C_j of at least one of the x blocks B_i , as a block replica to be used when executing said program.

30 According to a second object of the present invention, this solution is characterized in that the securing method comprises the steps of:

35 - creating, within said memory area, M replicas C_j ($j = 1, \dots, M$) of x program code blocks B_i ($x = 1, \dots, N$), wherein said replicas reside at different addresses within said memory area, and

- randomly selecting one replica C_j of at least one of the x blocks B_i , as a block replica to be used when executing said program.

Therefore, as explained in detail below, the device according to the invention prevents forgery by making the analysis of the electrical signatures very difficult to analyze by such forgery, taking advantage of the fact that said electrical signature varies, in particular, as a function of the values transiting over said device bus lines.

Other features and advantages of the invention will become apparent from the following description of preferred embodiments of the present invention, provided by way of non-limiting examples, in reference to the appended Figures, in which:

Fig. 1 illustrates an integrated circuit device, such as, for example, an electronic component-carrying card.

Fig. 2 illustrates a memory area in the card of Fig. 1.

Fig. 3 illustrates bus lines in the card of Fig. 1.

Fig. 4 illustrates the memory area of Fig. 2 restricted to code block B_i .

Fig. 5 illustrates addressing of a code block and its replicas within the card of Fig. 1.

Fig. 6 illustrates a distribution of a code block and its replicas within a memory area of Fig. 2.

Fig. 7 illustrates another distribution of a code block and its replicas within the memory area of Fig. 2.

Fig. 1 shows an integrated circuit device 10, for example an electronic component-carrying card.

Card 10 includes a controller (for example a central processing unit or CPU), a memory area 12 including a data memory 14 and a program memory 15, and a terminal block 13 for electrical connection, for example, to a card reader connector.

Memory area 12 is shown in Fig. 2. It contains a program P including N code blocks B_i ($i = 1, \dots, N$) forming code blocks representing steps or operations to be performed when executing said program P , which enables

performing operations such as reading or selecting data from card 10 and wherein said blocks B_i handle data and address information.

When executing program P, information interchanges take place between memories 14, 15 and controller 11, through bus lines within said integrated circuit, which are handled by controller 11 in said card 10. The bus lines are either lines for transferring address information, or lines for transferring data information. As shown in Fig. 3, data bus lines D1, D2, ..., D8 and address bus lines A1, A2, ..., A16 are connected to each of the data memory 14 and program memory 15 within each memory area 12 as well as to controller 11 (CPU).

In order to scramble the analysis of the electrical signature on execution of program P, which execution is a sign of card 10 being active, according to the present invention, the device comprises M replicas C_j ($j = 1, \dots, M$) of one or several blocs B_i within said memory area 12, and selection means M_s for randomly selecting one of replicas C_j of a block B_i as a block replica to be executed when the latter must be executed within said program P. When program P is executed, several code blocks B_i will be executed. Fig. 4 illustrates an example for a given block B_i . For each execution of this block B_i to be executed within program P and including replicas C_j within memory area 12, selection means M_s randomly selects either block B_i or one of its replicas C_j so as to execute it within program P. As the various replicas C_j as well as block B_i reside at different address values, on each new request for executing block B_i within program P, the bus lines do not carry the same address values and this makes analyzing the electrical signature, which varies according to the values transiting over the bus lines in card 10, much more difficult. The more replicated blocks B_i this device includes, the more difficult the signature will be to analyze. This is the reason why the invention provides replicas C_j for x blocks B_i ($x = 1, \dots, N$).

In particular, the electrical signature varies as a function of the values transiting over the address bus lines shown in Fig. 3, and more specifically, whenever information 1 is present on a bus line, which information requires a certain electrical current. However, if address values of the above-mentioned replicas C_j and said replicated block B_i are equivalent in terms of electrical consumption (for example their values 1111100000000000 and 0000111011000000 induce the same consumption since they each have the same number of bits equal to one and zero), the electrical signature will not change much. Thus, addresses are selected in such a way that the sum of bit values of at least two addresses among the set of addresses of a replicated block B_i and its M replicas C_j are different. In practice, it has been found that, generally speaking, a 1-bit difference among these sums was sufficient for differentiating the various electrical consumption amounts of the address values and therefore make the analysis of the electrical signature more complex. The example illustrated in Fig. 5 shows a block B_i with its three replicas C_1 , C_2 and C_3 and their respective addresses A_b , A_{c1} , A_{c2} and A_{c3} . In this example, it can be seen that the bit sums of address values A_b , A_{c1} , and A_{c3} are different and therefore, that the address values vary in electrical consumption whereas the bit sums of address values A_b and A_{c2} are equivalent (with their sum equal to seven) and that, as a consequence, their address values are equivalent in terms of electrical consumption.

Just as the electrical signature varies according to the values transiting over the address bus lines, the electrical signature varies according to the values transiting over the data bus lines shown in Fig. 3.

Thus, according to the present invention, among the set of addresses within a replicated block B_i and its M replicas (where block B_i includes operations for managing a given number of data), an address resides within program memory 15 and another address resides within data memory 14, as shown in the examples of Figs. 6 and 7. In this

respect, the execution of an operation, for example a read or write operation, residing in program memory 15, does not consume the same amount of current as when said operation resides in data memory 14. Operations of the replicated block Bi are seen from card controller 11 as data information transiting over the data bus lines.

Therefore, the above-mentioned system, where blocks are replicated within different memories, enables scrambling of the electrical signature, and it will be understood that this system, in combination with what has been described so far, makes the electrical signature even more difficult to analyze.

Finally, in addition to a random variation of the electrical signature due to the different systems provided within the device according to the present invention and as disclosed previously, the latter provides a random time variation of said signature. More specifically, the present invention provides a device comprising controller means for randomly scheduling the execution of blocks Bi. Each block comprises a set of operations relating to the electronic component-carrying card. These operations, when executed, invoke functions that are managed by card controller 11. For performing these functions, the controller takes time. In general, for each set of functions, the time consumed will be different, which is also the case for each set of operations. Thus, when using this controller means for random execution of blocks, on each new execution of program P, the electrical signature will vary in time since the code blocks are not executed in the same order, whereby, for example, a forger will not be able to repeatedly launch the execution of said program P and analyze the electrical signature in order to find matches between various processing operations and each signal or series of signals contained within the electrical signature. It will be noted that no auxiliary device has been added for countering such forgery.

CLAIMS

1. An integrated circuit device containing a memory area that comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks B_i ($i = 1, \dots, N$), characterized in that said memory area has M replicas C_j ($j = 1, \dots, M$) of x program code blocks B_i ($x = 1, \dots, N$), wherein said replicas reside at different addresses within said memory area, and in that said device comprises selection means for randomly selecting one replica C_j of at least one of the x blocks B_i , as a block replica to be used when executing said program.

2. A device according to claim 1, characterized in that the sums of bit values of at least two addresses among the set of addresses of one replicated block B_i and its M replicas C_j are different.

3. A device according to any preceding claim, characterized in that, among the set of addresses of one replicated block B_i and its M replicas, one address resides within the program memory and another address resides within the data memory.

4. A device according to any preceding claim, characterized in that it comprises controller means for randomly scheduling block execution.

5. A method for making secure an integrated circuit device containing a memory area, which comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks B_i ($i = 1, \dots, N$), characterized in that said method comprises the steps of:

- generating, within said memory area, M replicas C_j ($j = 1, \dots, M$) of x program code blocks B_i ($x = 1, \dots, N$), wherein said replicas reside at different addresses within said memory area, and

- randomly selecting one replica C_j of at least one of the x blocks B_i , as a block replica to be used when executing said program.

6. A method according to claim 5, characterized in that said method comprises the additional step of selecting the sums of bit values of at least two addresses among the set of addresses of one replicated block B_i and its M replicas C_j in such a way that they are different.

7. A method according to claims 5 or 6, characterized in that, among the set of addresses of a replicated block B_i and its M replicas, an address is selected within the program memory and another address is selected within the data memory.

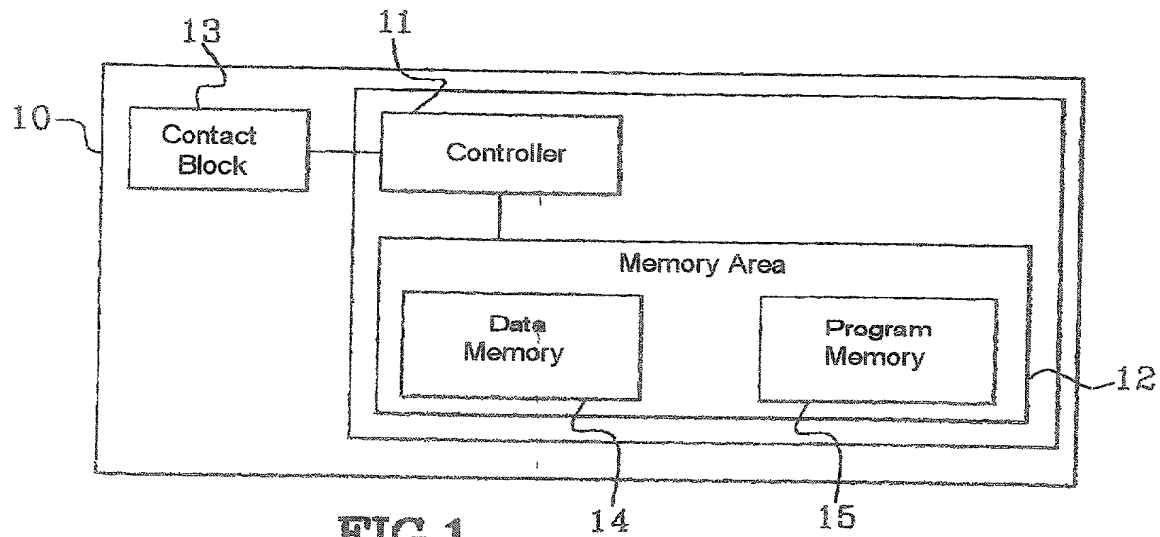
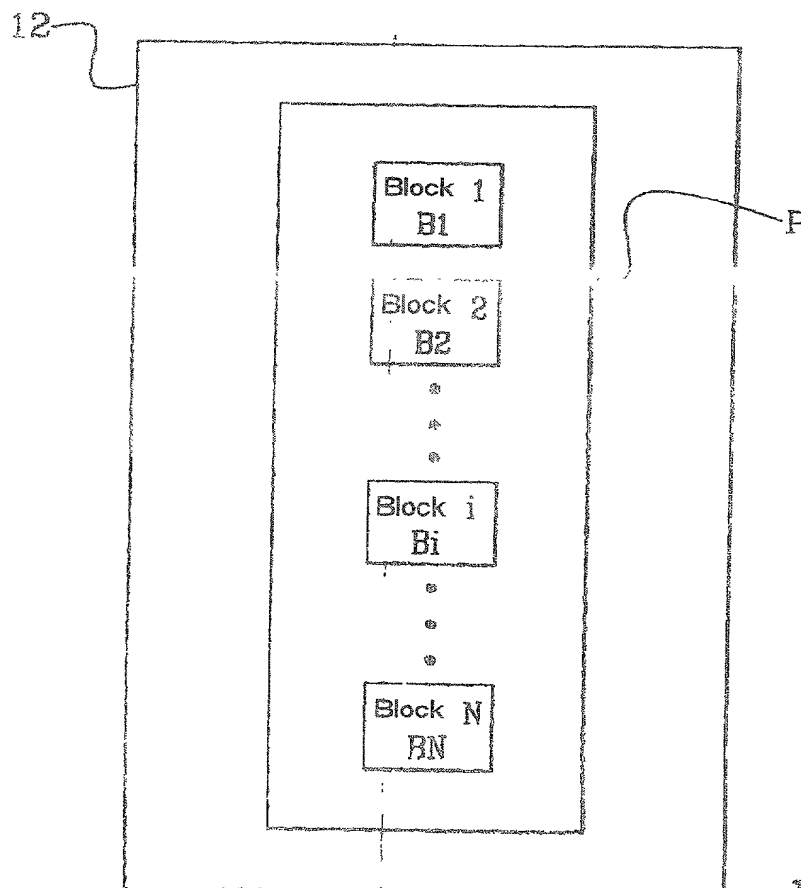
8. A method according to claims 5, 6 or 7, characterized in that said method comprises the additional step of randomly scheduling block execution.

ABSTRACT

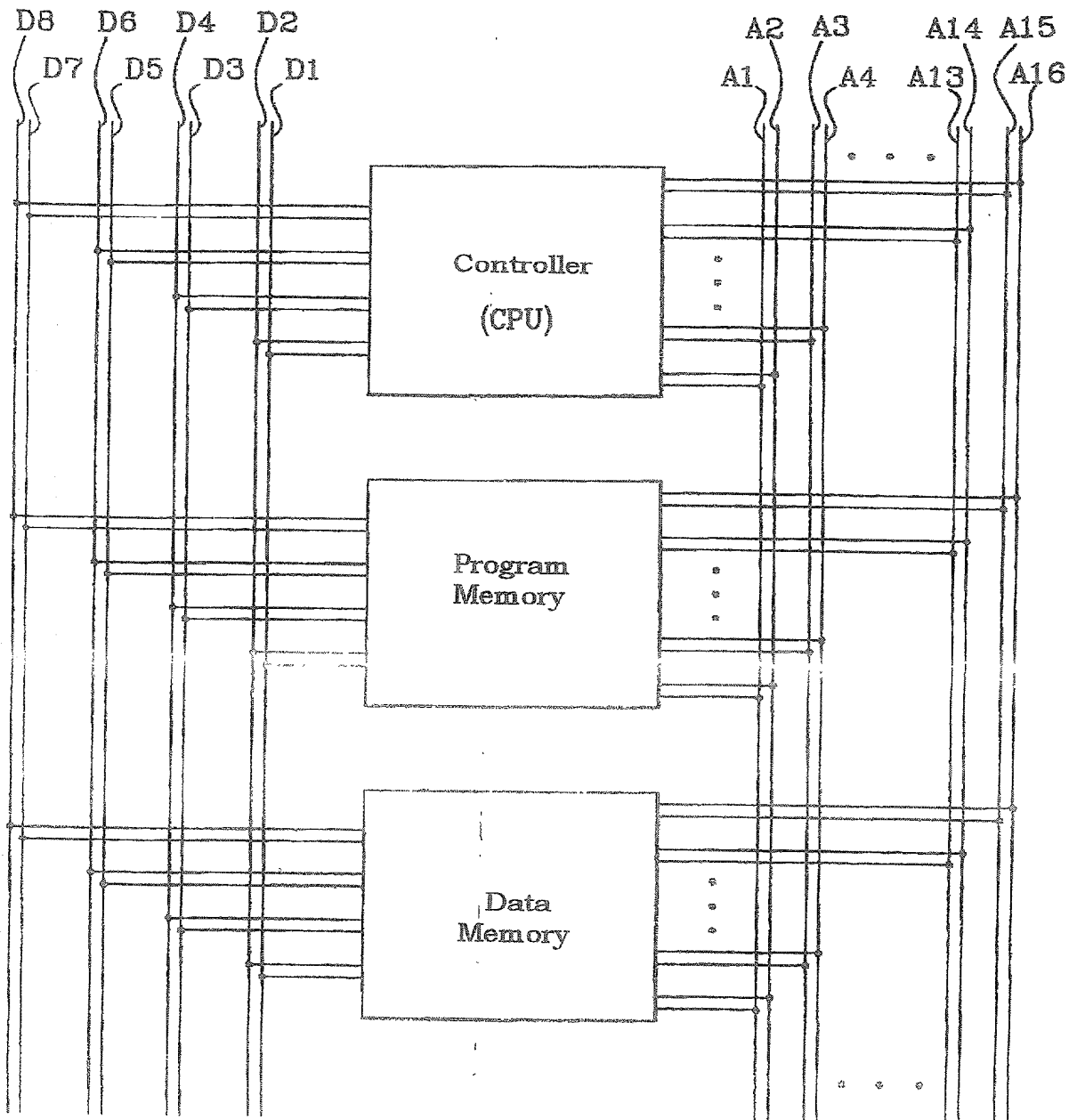
5 The present invention relates to an integrated circuit device containing a memory area, which comprises, on the one hand, a data memory and a program memory, and on the other hand, a program having N code blocks B_i ($i = 1, \dots, N$). It also relates to a method for making such a device secure. The present invention is characterized in that the memory area has M replicas C_j ($j = 1, \dots, M$) of x program code blocks B_i ($x = 1, \dots, N$), which replicas reside at different addresses in said memory area, and in that said device has selection means for randomly selecting one replica C_j of at least one of the x blocks B_i , as a block replica to be used when executing said program. In particular, the present invention can be applied to smart cards.

Fig. 4.

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FIG.1FIG.2

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FIG.3

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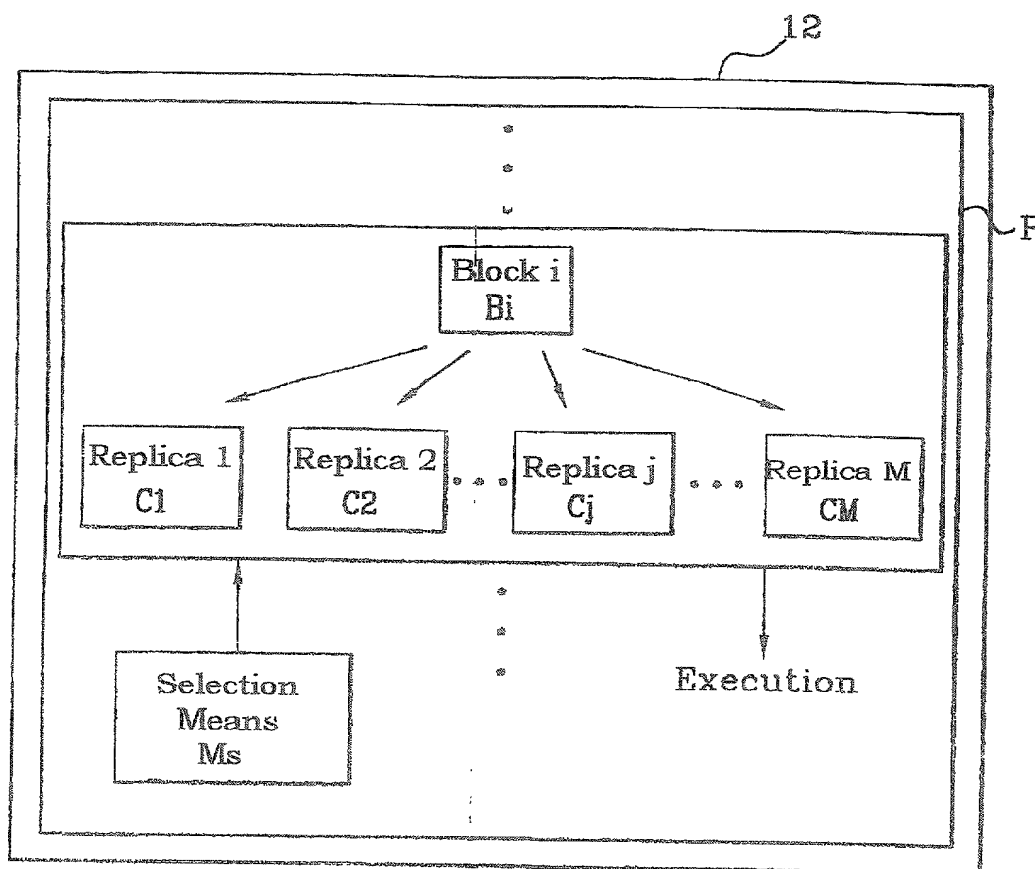


FIG. 4

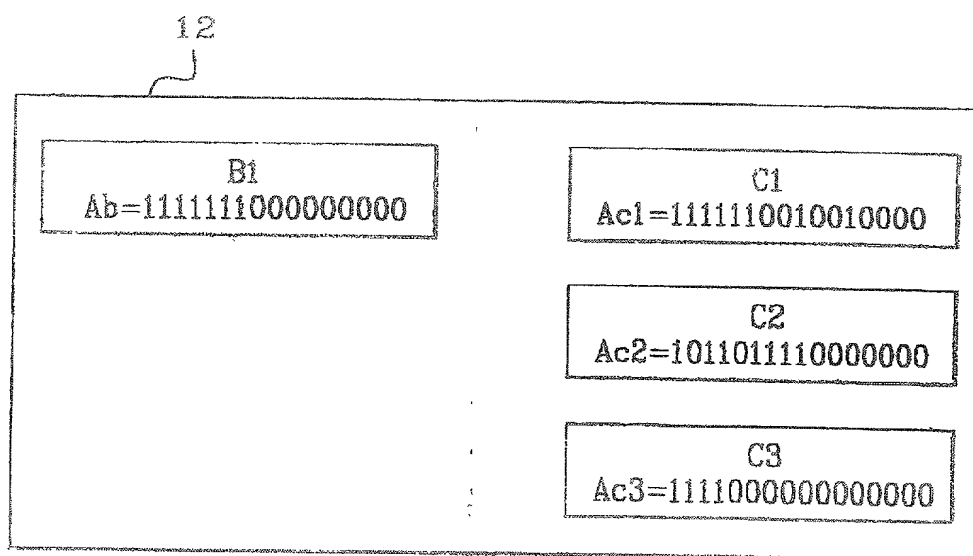
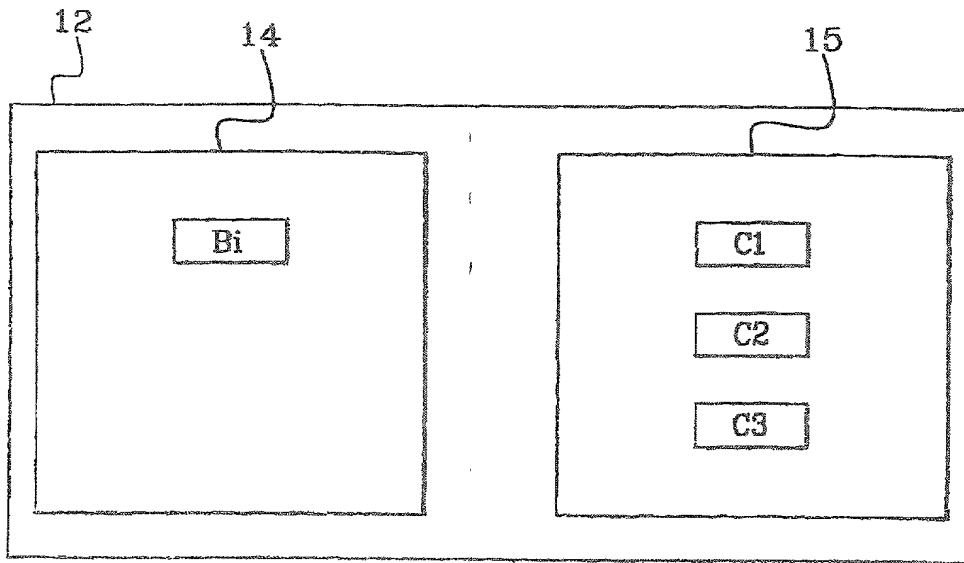
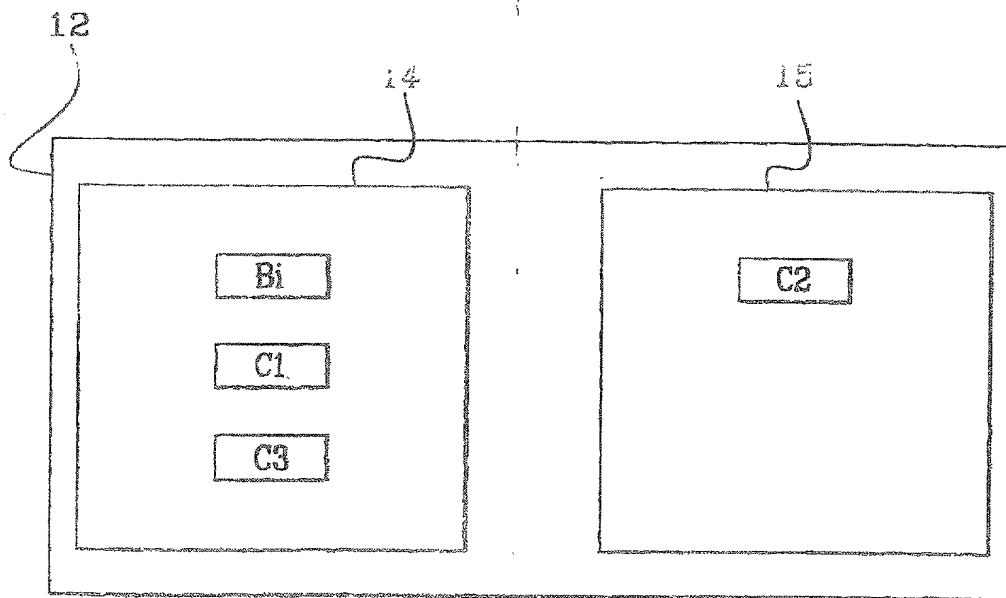


FIG. 5

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FIG. 6FIG. 7

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Application Number	09/ 830, 378
Filing Date	April 29, 2001
First Named Inventor	Eric GERBAULT
Title	Device and method for
Group Art Unit	
Examiner Name	
Attorney Docket Number	01245/1L

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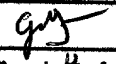
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Name	Eric GERBAULT
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**DECLARATION FOR UTILITY OR
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(37 CFR 1.63)**

☐ Declaration Submitted with Initial Filing **OR** ☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number 01245 / TL

First Named Inventor GERBAULT

COMPLETE IF KNOWN

Application Number 09 / 830, 378

Filing Date April 29, 2001

Group Art Unit

Examiner Name

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Device and method for making an integrated circuit secure.

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY)

04/ 29/ 2001

as United States Application Number or PCT International

Application Number 09/ 830, 378 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

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[Page 1 of 2]

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Eric.

Family Name
or Surname

GERBAULT

Inventor's
Signature

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May 15th, 2002

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09/830378

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Name

Thomas Langer, Reg. No. 27,264

Signature

Thomas Langer

Date

April 25, 2001

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